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JULY, 1905.

The Aëronautical Journal.

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NOTICES OF The Aëronautical Society of Great Britain.

The concluding meeting of the Fortieth Session of the Aëronautical Society of Great Britain will be held at the Society of Arts, John Street, Adelphi, on Wednesday, July 12th next, at 8 p.m. The President, Major B. Baden-Powell, will take the chair.

The following papers will be read :—

"Some Remarks on Aërial Flight," by Mr. F. H. Wenham, Honorary Member of the Aëronautical Society of Great Britain.

After this paper Dr. F. W. H. Hutchinson, M.A., B.Ch. (Cantab.), M.Aër.Soc., will give a demonstration with the bird-like Flying Model devised by Mr. E. P. Frost, J.P., Mr. C. R. D'Esterre, and himself, an account of which appears in the current number of the "Aëronautical Journal."

"Balloon Varnishes and Their Defects," by Mr. Walter F. Reid, C.E., F.I.C., F.C.S., M.Aër.Soc. (late Chairman of the London Section of the Council of the Society of Chemical Industry).

"The Thrust of Aërial Propellers" (with experimental Illustrations), by Mr. William George Walker, C.E.

THE LIBRARY.

The Library is open to members during the session, for reference and the borrowing of books, on the first Monday of the month, from 2 to 5 p.m., unless notice is given to members of change of date. As the first Monday in August is a Bank Holiday, and the second Monday in the Vacation, the Library will be open instead on Monday, July 31st. Due notice will be given of the re-opening of the Library after the Vacation.

The following publications have been presented to the Library :—

By Major B. Baden-Powell: Various numbers United Service Journal.

By Colonel F. C. Trollope : "Publications of the International Aëronautical Commission" (October and November, 1903) ; "Observaciones del Eclipse Total de Sol de 30 de Agosto de 1905 : Por medio De Globos—D. Pedro Vives Y. Vich.

By Mr. A. Lawrence Rotch : "The St. Petersburg Conference on the Exploration of the Atmosphere."—A. Lawrence Rotch.

By M. Emile Wenz : "Parti que l'on Peut Tirer, dans Plusieurs Branches de la Science du Cerf-Volant enlevant des appareil."—Emile Wenz.

By Herr Ignaz Dickl : "Zur Effektberechnung von Flugvorrichtungen."

By D. F. Sacco : "L'Aérovoie."—F. Sacco.

FLYING MODEL COMPETITION.

The Flying Model Competition for the prize of ten pounds offered by Major B. Baden-Powell will be held at the summer meeting of the Aëronautical Society of Great Britain in 1906. The conditions and rules of the competition will be published in the October number of this journal. All communications respecting this competition should be addressed to the honorary secretary,

Aëronautical Society of Great Britain, 53, Victoria Street, Westminster, London.

ERIC STUART BRUCE,
Honorary Secretary.

AËRONAUTICS AND METEOROLOGY.

The admirable exhibition of meteorological instruments which was organised by the Royal Meteorological Society in March last, and held for four days in the spacious rooms of the Institution of Civil Engineers, was perhaps the most complete yet arranged by the Society which devotes itself to the study of the atmosphere. The whole undertaking reflected the highest possible credit on the council and secretaries of the Society. Too much praise cannot be bestowed on the manner in which the various exhibits were classified and catalogued, and the general arrangements of the display once more brought into prominence the skilful organising powers of the assistant secretary.

The address given in the afternoon descriptive of the features of interest was a welcome innovation. In fact, there was no excuse for the visitor to this exhibition to come away ignorant of the reasons for the presence of each specimen.

This exhibition showed in a very high degree the close connection which has necessarily grown up between aëronautics and meteorology—each one dependent on the other. If kites have an intense interest for the meteorologist because of their use in taking up recording instruments to considerable heights where there are atmospheric conditions isolated from the disturbing influences of the earth, such instruments as those which measure and record wind pressure have an equal fascination for the aëronaut, as must also every method which facilitates a more accurate and longer forecasting of the weather.

Mr. W. H. Dines contributed several interesting exhibits connected with scientific kite flying with which his name has been so prominently associated, and included a kite with meteorograph in position, a kite for strong winds folded up, samples of wire for kite flying, a meteorograph by M. Teisserenc de Bort used at Crinan in 1903, and a Dines meteorograph. Mr. W. S. Bruce exhibited a meteorograph used with a kite in the Scottish Antarctic Expedition; also a kite, camera, and cage used in the same expedition. Besides the meteorograph of M. Teisserenc de Bort exhibited by Mr. Dines, the former himself contributed three specimens of meteorograph. Two for use with the kites, and one for use with ballons-sonde.

Mr. P. Y. Alexander, to whom belongs the credit of having been the only observer to send up ballons-sonde in this country, and thus linked it to the International Exploration of the Air, carried on by the International Aëronautical Commission, exhibited two small rubber ballons-sonde. Amongst other exhibits were the very sensitive atmospheric barometer called a statoscope for use in balloons, Richard's self-recording baro-thermo-hygrometer, Hergesell's baro-thermograph for ballons-sonde, an altimeter for registering the height to which kites and other aërial machines rise, and a Russian kite with curved surfaces.

The choice collection of meteorological photographs on view alone repaid a visit to this exhibition. Perhaps to the aëronaut whose ways are amid the clouds the variety of cloud photographs would possess the greatest charm. The unrivalled collection of photographs of lightning flashes possessed by the Royal Meteorological Society, even when seen over and over again, never fail to arrest attention and re-examination. And to the aëronaut who, like the mountaineer, can mount above the storm region and in serenity of atmosphere watch one of Nature's grandest phenomena, these lightning records must have also had a fascination.

Notes on a Bird-like Flying Machine.

BY DR. F. W. H. HUTCHINSON, M.A., B.C. (Cantab.).

To those who have not given attention to the structure of a bird's wing the following rough description may be of interest. The wing of a bird may be regarded as having two portions: (1) that part to the outer side of the wrist joint. The main feathers of this portion are usually about ten in number, and are known as the primary feathers. (2) That part of the inner side of the wrist joint which may be called the body of the wing. The main feathers of this portion vary according to the length of wing.

(*a*) A salient characteristic of a bird's wing as a whole is the comparatively rigid and heavy anterior edge and the light yielding elastic posterior margin.

(*b*) If the primary feathers be examined carefully it will be seen that each one differs from its fellows, and that they differ in a graduated series. The quill is curved, and the feathered portion, or penna, is set round this in a helicoidal curve. Here, again, the portion anterior to the quill is stiff compared to the portion behind it.

(*c*) Another characteristic of a bird's wing is that a fore and aft vertical section through the body of the wing discloses a curve somewhat of this shape.

Front. Rear.

This curve is more pronounced about midway between the wrist and the shoulder joint—*i.e.*, in the region of the elbow. When the wing is in the extended position for flight this joint is distinctly behind the front edge of the wing. (Mr. Hargrave, of N.S. Wales, has devoted study to this curved portion, and it may, perhaps, be convenient to describe the curve as the Hargrave curve.)

Mr. E. P. Frost, of West Wratting, a well-known member of the Council of the Aëronautical Society of Great Britain, as a result of careful observation of the structure of natural wings of all kinds, and of the movements of wings in flight, came to the conclusion more than twenty years ago that for ordinary flight a wing is merely beaten up and down.

It is obvious that, owing to the yielding elastic posterior edge of a bird's wing, on the wing being beaten downwards both a lift and a drive is obtained.

It is also obvious that on the wing being elevated a forward and downward resistance is evoked. (But the wing is so shaped that the down stroke must encounter greater air resistance than the up stroke, apart from consideration of the amount of energy put into the up and into the down stroke. Also the arrangement of the wing feathers causes a valvular action. Air passes through the body of the wing on the up stroke.)

Mr. Frost has contended that the result of the arrangement of the primaries must be that on being struck downward in the air, their ends travel forwards and upwards. In flight the wing tips of a bird (*e.g.*, a rook) can be seen to be curved upwards. If a shed primary feather be taken and held in its natural orientation and struck smartly down in the air the tip can be seen to spring markedly forward. Then the posterior edge of the penna becomes tense. But when the feather is not so stressed the posterior edge is sinuous and has a fulness. Other (normal) movements have been described, notably the so-called "figure of eight" curve generated by the movements of the wing tips; but Mr. Frost has contended that the movements of the wing tips, in what may be considered normal steady flight, are the automatic results of the peculiar construction of the wing, and of its being beaten up and down against the air.

If during the down stroke the primary feathers are strained forward and upward within their elastic limits, it is obvious that energy is stored in them, and its restoration may in part occur even on the up stroke.

The curve (Fig. A) is taken from Marey's "Le vol des oiseaux," and the following description extracted from the text. It was photographically obtained, and shows the movements of a piece of white paper fixed to the tip of the first primary of a black crow. The crow was caused to fly in front of a dark screen, and the lens exposed during five beats of the wings. The curve shows only the trajectory of the white paper; and Marey directs attention to the increase of distance between successive loops due to the increasing mean velocity of the bird.

The recurving at the bottom of the loops would seem to be due to the restoration of energy from the forward-stressed feather. (The portion which the present writer ventures to indicate between the lines k and k^1 seems to be from just before the commencement of the down stroke to the commencement of the next.)

The curve (Fig. B) was recently obtained

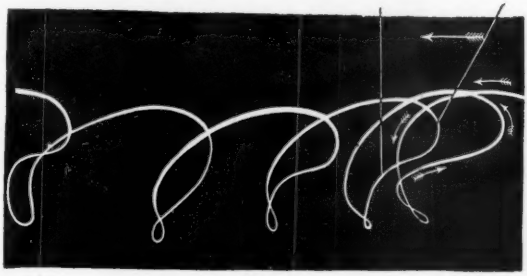
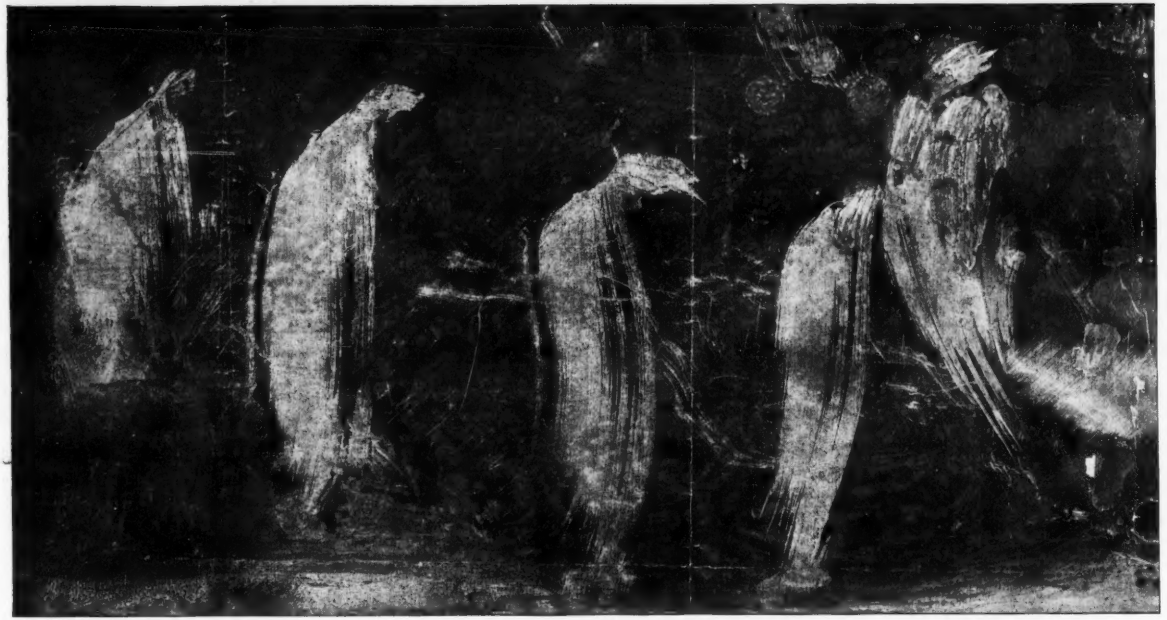


Fig. A.



Direction of Flight. <————

Fig. B. — Trajectory of Bird's Wing.

The above and accompanying illustrations by kind permission of Editor of "Knowledge and Scientific News."

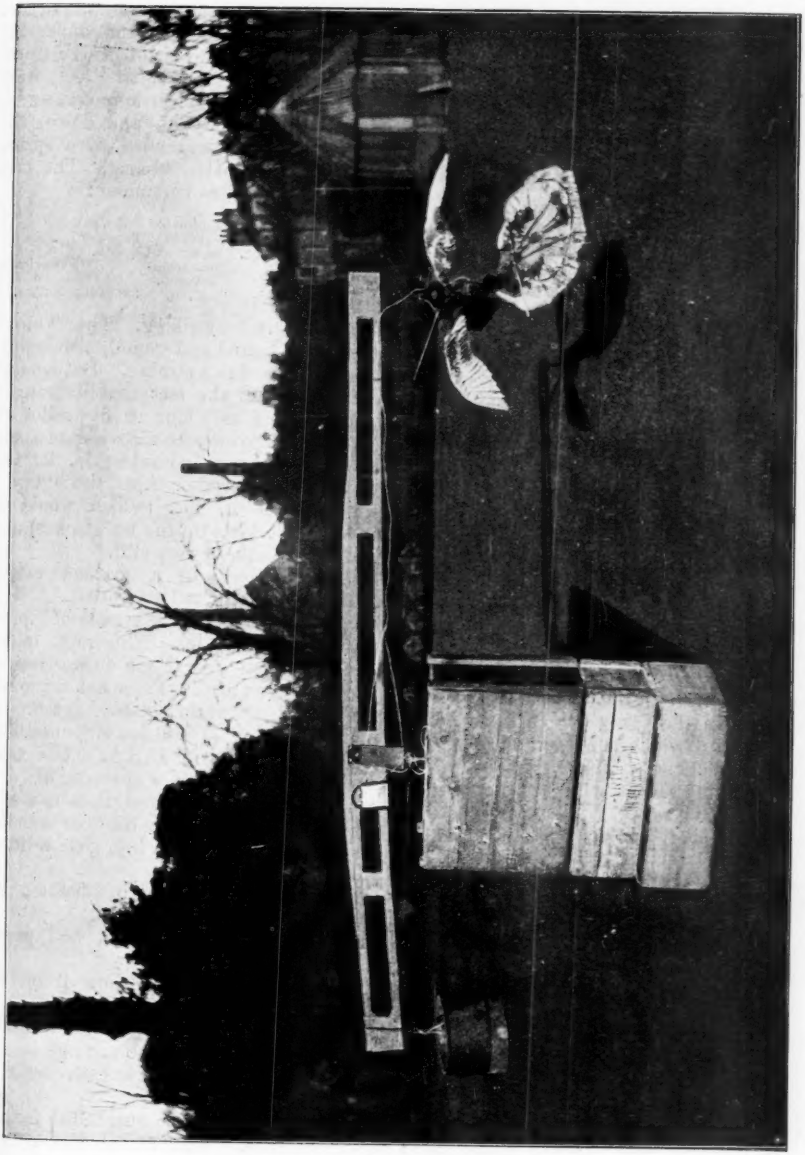


Fig. 1.

by Major B. Baden-Powell in the following way. Small birds were procured, and tubes of paper were prepared whose internal diameters were approximately the distance between the tips of the outstretched wings of these birds. The internal surfaces of the tubes were covered with a coating of lamp-black. A tube was then arranged with one end in a room and the other end pointing out of doors through an open window, and a bird liberated within the inner end of the tube. As it flew out towards the light a record of the movements of the wing tips was obtained. Several observations were made, a fresh tube being used each time. The curve traced was somewhat as in Fig. B.

The dotted portion was only faintly shown on the record. Major Baden-Powell considers this to represent the up stroke, and that it shows the wings slightly to be flexed on the up stroke.

The writer ventures to think that the difference in the distinctness between the two portions is due to the wrist being in a slightly flexed condition on the up stroke in what may be considered the normal position, and that on the down stroke the stressing of the primaries automatically increases the distance between the wing tips and opens the wrist automatically against its elastic reaction. The *wing as a whole* is essentially an elastic structure. The absence of re-curvation at the lower portion of the record, taken in conjunction with the form of the down stroke record, would seem to show that (being in the tube) the bird was not flapping at full vigour, or quite normally, and that stored energy of the primaries was given out during the latter part of the down stroke.

During flapping flight the primary feathers automatically exert a clawing swimming action.

In reference to the Hargrave curve, Mr. Hargrave has demonstrated that when air is blown against such a curved surface thus—

—a lift is obtained against the bight of the curve. He arranged little trap doors, opening upwards, which opened under the influence of an air current, as shown by the arrow.

This is doubtless due to the formation of eddies by the air flowing over the rigid lip.

It is obvious that a bird's wing, both as a gliding and a propelling surface, is a beautifully efficient instrument.

To test these views, in 1902, Mr. Frost and the writer, with the co-operation of Mr. C. R. D'Esterre, arranged the apparatus shown in figure 1. A pair of dried natural wings (area about three square feet) were arranged with a small electric motor, and a reduction gear to flap up and down, the arrangement being suspended by a spring balance from the balanced arm. The best result was obtained as hereunder:

Volts.	Amps.	Estimated h.-p. on wings.	Estimated loss in motor and gear transmission.	No. of flaps per min.	Maximum lift.
24	12	$\frac{1}{10}$	75%	350 to 400	5 lbs.

The effect was striking. The "bird" flapped itself round and round, although it fell between the down strokes. But against this must be set the fact that its rate of progression was only four or five miles an hour, no doubt owing to air resistance and friction, which were considerable, for the apparatus was crude. Also the "bird" weighed about 27 lbs. (which would of course pull it down on the up strokes) and the primary feathers were stiff.

The oscillations to a marked extent diminished after the tail was fitted.

It will be noted that the ratio of h.p. to lift was 1 h.p. to 50 lbs. This ratio tallies with that given by various authorities as that obtaining with birds and is not in marked contrast with the ratio obtained (according to published reports) with the large machine of Messrs. Wright in U.S.A. One may describe a flying lift and a hovering lift.

The hovering lift obtained in a confined space, and only 3 feet above the floor with the figure 1 apparatus with 1 h.p. gave a lift of 10 lbs.

We considered we had justification for proceeding with a larger model.

This has been constructed and partly tested.

The succeeding figures show it on the rough carriage.

It is intended to run this car on a special trough section track, and to arrange in the frame 4 vertical guides, one at each corner, of stretched cord or wire.

The machine will be suspended from a spring balance. The model has certain crudities in the motive portion, although the workmanship (which, apart from the wings, was carefully carried out by Messrs. Pye, Scientific instrument makers, of Cambridge,

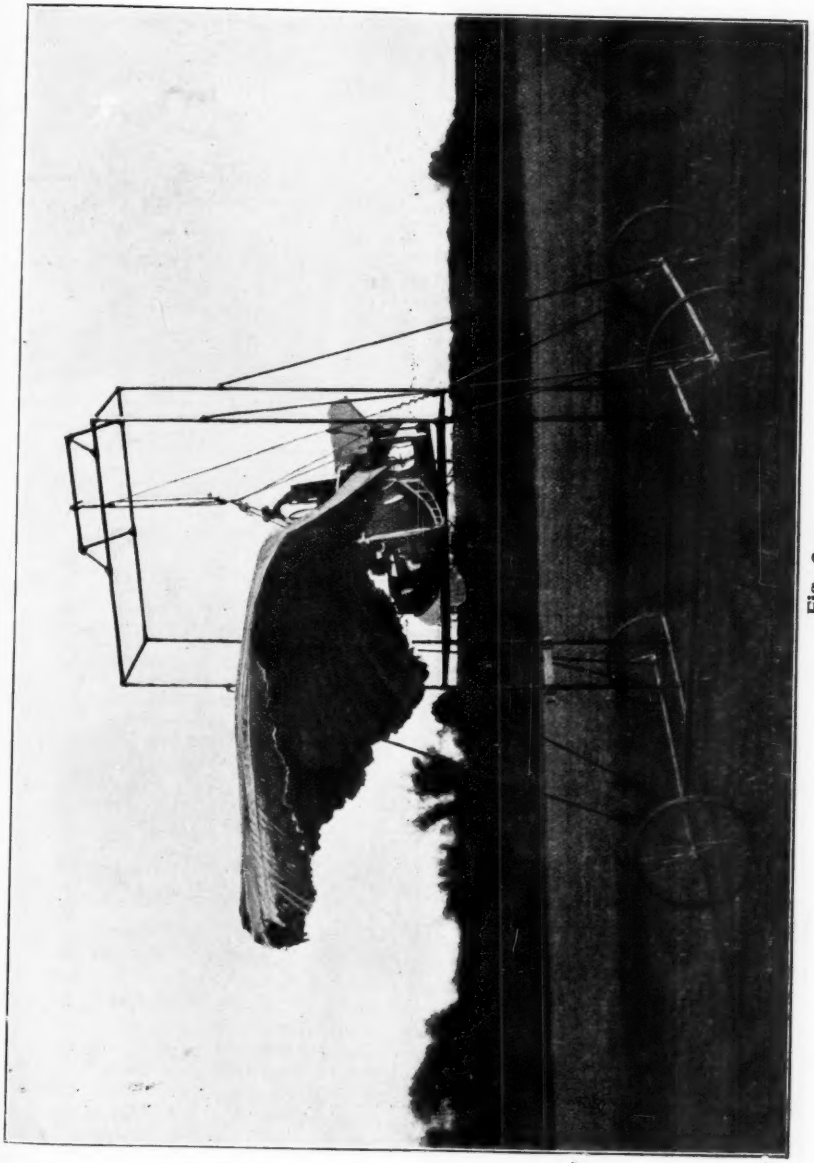


Fig. 2.

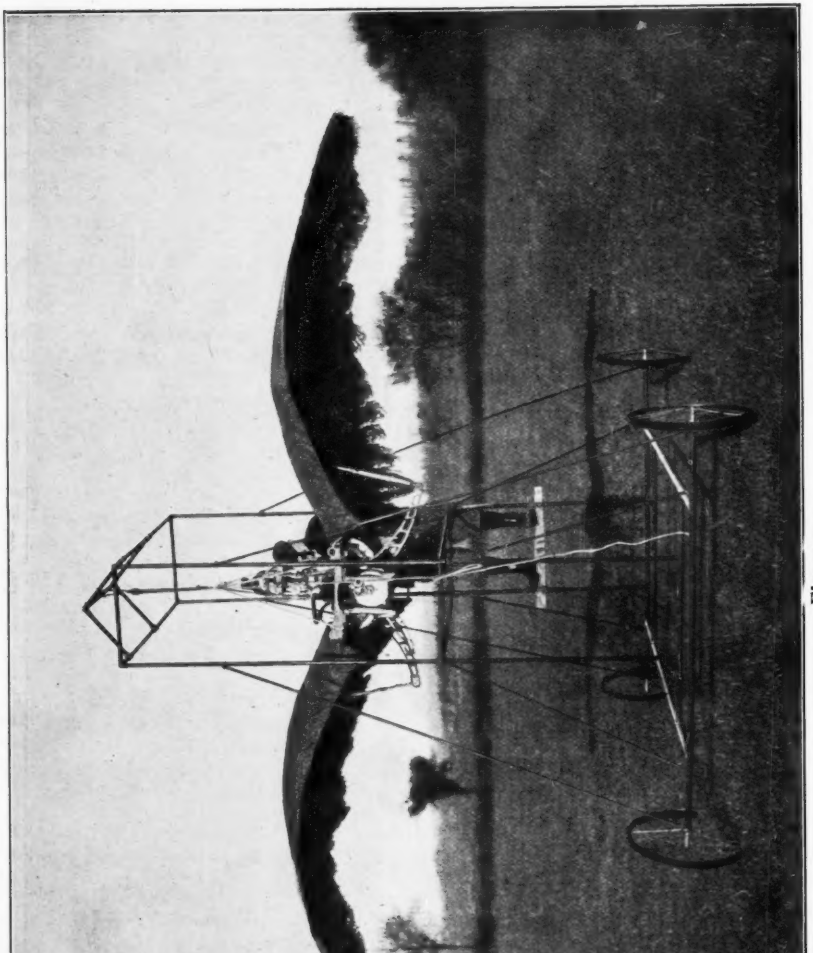


Fig. 3.

and the Cambridge Autocar Company, Limited) is good. But it is a testing model only and is merely intended to obtain data from.

The wings are of special construction, designed in accordance with the above enunciated principles.

The total wing area is about 20 times that of the No. 1 model (*i.e.*, about 60 square feet).

The machine measures about 20 feet across.

The figures give a fair idea of the machine.

The transmission is by coned friction clutch, and chains in two stages, to connecting rod. The crank throw is adjustable for altering the size of angle of flap. The top sprocket of second motion can be raised or lowered for altering the limiting positions of the wings (*i.e.*, the position of the arc). The lower end of the connecting rod actuates the inner ends of the levers for wagging the wings by a simple device of two oscillating roller-carrying links attached to the cross head, whose pin is constrained by vertical guides.

To the brackets, seen below the wings, are attached "pectoral cords" of elastic.

These store up energy on the up stroke, and so obviate too violent alternations of load on the driving mechanism.

The motor is a nominal 3 to 3½ h.p. petrol cycle engine.

The wings are at present arranged to flap 100 times a minute, which is, of course, considerably less than proportionately corresponding to the increased area and h.p. But increased area does not imply proportionally increased resistance.

The machine has been suspended from a tree bough, and the wings flapped under power. The results are very promising. At each down stroke the whole machine, apart from the carriage, weighing 232 lbs., is lifted up bodily into the air and forwards. It rises about 2 feet each stroke. It looks just like a gigantic bird trying to fly under similar conditions. At the down strokes the suspending rope leaves the vertical and becomes markedly inclined. The pull on the rope then pulls the machine back, so that even if it be capable of flight it cannot fly under these conditions. At the down stroke it seems that, if the rope were then severed, the machine would travel up and away with the powerful sweep of the wings. The spring balance reading is here obviously fallacious so far as registering the lift goes, because the rope is pulling the machine back. However, at the rough tests so far made, the balance shows a diminution of reading of from 80 to 160 lbs. at the down stroke, when the machine springs upwards but also forwards.

At the preliminary trial already made the wings described a diminished angle to that of the No. 1 model.

It should be noted that with this angle and 100 flaps per minute, the wings appear capable of evoking a resistance of about 100 lbs. each, and the machine is raised about 2 ft. at each stroke. At the only test so far made the machine was working at great disadvantage, it being near the ground in eddying air and not having proper forward velocity.

The model is susceptible of considerable lightening.

In the model we have nearly 33 square inches per lb.

There are grounds for believing that a feathered wing made of a number of units can exert a greater resistance than a single wing, such as that of the insect or bat type, or the various simple mechanical wings which have hitherto been used in wing flapping machines. There are experimental grounds for believing that resistance is more dependent on periphery of an aëroplane than on its superficial extent.

Furthermore the primary feathers almost certainly act as a series of stepped aëroplanes, each acting on air from a different level, which has not had a downward velocity imparted to it by having had to sustain the weight of a previously acting supporting surface.

The Spanish Provisional Programme of Balloon Observations in the Coming Total Eclipse.

Owing to the courtesy of Don Pedro Vives Y. Vich we are enabled to publish the following programme, the English translation being by Helen Auxilium Bruce.

MILITARY AËRONAUTICAL PARK, GUADALAJARA.

Provisionary programme of balloon observations of the solar eclipse of August 30, 1905.

A.—EARTH STATIONS.

At the Military Aëronautical Park the usual meteorological observations on August 29, 30, and 31.

EARTH STATION AT BURGOS.

APPARATUS.—Aneroid, aspiro-psycrometer, néphoscope; and as supplementary apparatus, electric lanterns and A. de Quervain's recording barometer and theodolite.

Facilities complete for sending up ballons-sonde and pilot balloons if desired.

August 29.

STAFF.—Two officers of the Balloon Corps and the appointed astronomical observers.

OBSERVATIONS.—1. Pressure, temperature (wet and dry bulb), wind and clouds, taken every hour from sunrise to sunset.

2. Ballons-sonde ascent at 12.50 p.m.

August 30.

STAFF.—Four officers of the Balloon Corps and the observers appointed.

1. Meteorological observations similar to August 29, but carried out in the following order:—

Every 30 minutes from sunrise to 10 o'clk.
,, 10 ,, ,, 10 to 12 p.m.
,, 5 ,, ,, 12 to 2 p.m.
,, 10 ,, ,, 2 till 4.
,, 30 ,, ,, 4 till sunset.

2. Three ballons-sonde ascents.

The first at 10.30 (before the eclipse).

The second at 12.50 p.m. (some moments before totality).

The third at 2.20 (after the eclipse).

3. Ascent of 6 pilot balloons without apparatus, constructed to ascend to 2,000 mètres above sea level, to show the direction of the wind.

The first will ascend at 10.24.
The second ,, ,, 11.24.
The third ,, ,, 12.24.
The fourth ,, ,, 1.24.
The fifth ,, ,, 2.24.
The sixth ,, ,, 3.24.

4. Records of the eclipse, mainly photographs and drawings of the corona, with the means obtainable.

August 31.

STAFF.—Same as on the 29th.

OBSERVATIONS.—As on the 29th, and at the same hours, including a ballons-sonde ascent.

B.—ASCENT OF CAPTIVE KITE-BALLOON.

APPARATUS.—Aneroid, aspiro-psycrometer, recording anemometer, and, as supplementaries, a barothermograph and an electric lantern for reading the records.

August 30.

STAFF.—Two officers of the Balloon Corps (one in the car and one to superintend the aëronautical work on the ground), also a meteorological observer (in the car).

OBSERVATIONS.—The balloon will be kept as nearly as possible at a height of 700 or 800 mètres above the ground, and in the car exactly the same meteorological observations will be taken as at the ground station beneath, at the same hours, and with identical sets of instruments, with the object of noting the variations in the results obtained at the two stations.

At the earth station, besides managing the captive machinery, observations will be taken of the length, inclination, strain and direction of the cable, to ascertain the height of the balloon. The observations will be made every ten minutes, also additional memoranda of the intermediary maxima and minima.

C. — THREE FREE BALLOON ASCENTS (two on August 30 and one on the 31st).

APPARATUS.—Aneroid, aspiro-psychrometer, camera, and, as supplementaries, a barothermograph and electric lantern, Also, if found possible, and if there are observers sufficiently skilled in this class of work, binocular spectroscopes will be taken up.

August 30.

STAFF.—Four officers of the Balloon Corps (two to pilot the two free balloons and two to superintend the ascents) and one or two observers in each balloon.

OBSERVATIONS will be taken in the following conditions:—

Ascent of the first balloon at 12 p.m.

Ascent of the second balloon at 12.5 p.m.

The two balloons will be prepared to ascend to 4,000 or 5,000 mètres.

The ascents will made with the advancing penumbra, and it is proposed the aëronauts should attain their maximum height at the time of totality.

The meteorological observations in the free balloons will be taken at the times indicated for the captive balloon and the

earth station, and in addition the usual observations will be taken of the speed and direction of the balloons.

It is thought only one balloon will be able to take up three persons, the other taking up two; three aëronauts will, however, be supplied for each. If one balloon can only take up two they will confine their attention to meteorological, photographic, and aëronautical observations, while the three aëronauts in the other balloon will, in addition, make drawings of the corona and spectroscopic observations, dividing the work amongst them so as to utilise every precious moment of totality.

The pilots of these free balloons will do their best to keep them during the eclipse at a minimum height of 3,000 mètres above sea level.

AUGUST 31.

STAFF.—Two officers of the Balloon Corps (to pilot the balloon and to direct the ascent), one observer.

OBSERVATIONS.—A free balloon will go up at 10.30, and every attempt will be made to keep it up till 3 p.m. During the ascent the usual observations for the international manned ascents will be taken.

The object of this ascent is to use the gas of the captive balloon of the 30th, and to compare the results of the observations which will be made in the car with those obtained in the free ascents and at the earth station on August 30. With this end in view, an attempt will be made to attain the same heights, and the observations will be made at the same hours as on August 30.

REMARKS.

All watches used will be set to Madrid time. All the apparatus used will be examined and corrected. This does not apply to the ordinary equipment of a car, such as mariner's compass, &c.

All the manned balloons will be piloted by officers of the Balloon Corps, but the other observers may be astronomers, meteorologists, or officers scientifically qualified. The aëronautical observers may be Spaniards or foreigners, but a place will be reserved in the car of one of the free balloons of August 30 for the nominee of the President of the International Scientific Aëronautical Commission, and as a mark of respect to the Commission I propose to pilot this balloon myself.

The other observers will be selected by the authorities of the Aëronautical Park, in accordance with the instructions of the Minister of War, and bearing in mind that those who observe in the free balloons must all be aëronauts familiar with balloon manipulation. With this end in view, they will be appointed in May so as to give them time to prepare themselves for the class of observations to be entrusted to them.

Those who receive the Provisionary Programme, and who wish to make any remarks on it, are requested to address them to the

Chief of the Aëronautical Park,
Guadalajara, Spain.

and as speedily as possible, so that he may receive their advices before preparing the final programme.

Guadalajara, March 6, 1905.
Lieut-Col. of the Aëronautical Park.

A Scientific Balloon Ascent from Berlin.

By A FELLOW OF THE ROYAL METEOROLOGICAL SOCIETY.

At the meeting of the Royal Meteorological Society on February 15 last, an exhaustive paper was read by Messrs. Hermann Elias and J. H. Field on the scientific ascent of the balloon "Brandeburg" from Berlin on September 1, 1904. By reason of the excellent arrangements made for carrying out the observations, the ascent may well serve as an object-lesson in such work. It goes far to emphasise the usefulness of ascents with manned balloons for scientific observation, and reminds explorers of the air that though ballons-sondes are invaluable for carrying out observations with self-recording instruments at heights inaccessible to human beings and kites have their special value in affording opportunities of continued research in isolated conditions, still there is an undoubted gain when intelligence can regulate the use of instruments and apply them to the circumstances of the moment. For the substantial record of the meteorological observations secured in this ascent the reader must be referred to the publication of the above-mentioned paper in the quarterly journal of the Royal Meteorological Society, April, 1905. Accompanying it will be found explanatory charts and the table extracted from the log of observations. It must suffice in the present article to point out one or two features of special interest.

The ascent was in conjunction with the

international ascents carried out by the International Aëronautical Commission. The balloon "Brandenburg" belonged to the aëronautical observatory of the Königl. Preuss Meteorologisches Institute and had a cubic capacity of 44,100 cubic feet, being filled to 35,000 cubic feet.

The start was made from Reinichendorf at 8.13 a.m. The distance travelled by the balloon was 33 miles. The distance of place of descent (near Schwanebeck) from place of ascent was 10·5 miles. The average velocity was 2·2 métres p. s. The mean direction N. 66° E. The time of the journey was 6 hrs. 39 mins. The greatest height attained was 23,110 feet. The lowest temperature registered was 24° C.

The instruments used in the ascent were Assman's aspirated dry and wet bulb psychrometer, a radiation black bulb thermometer with vacuum jacket, mercury and aneroid barometers, a recording aneroid and vertical current anemometer.

The observations of aërial currents in different directions at different altitudes is of the most extreme importance for progress in aërial navigation. The manner in which the direction and velocity of the wind was determined from time to time is therefore of special interest. It was done by tracing in a hand map the path of the end of the overhanging trailing rope seen projecting against the ground below. In the course of the ascent two main air-strata were encountered. "The first from ground-level up to 3,500 m. (11,500 ft.), with a prevalent wind, direction due east, the second, separated from this by an inversion 200 m. (650 ft.) thick, giving a 3° C (5°·4 F.) departure from an adiabatic curve—extending upwards to the maximum height reached, and showing a prevalent westerly wind direction. On the descent three main strata were met with: from 7,000 m. (23,000 ft.) to 5,000 m. (16,400 ft.), from 5,000 m. to 2,000 m. (6,600 ft.), and from 2,000 m. to ground level, the separations being effected in each case by small invasions of about 1°·5 C (2°·7 F.). The general direction of the wind during descent was from the south-east, but its velocity was only small till the balloon reached the south-south-west or surface wind at about 350 m. (1,200 ft.) above the ground."

The observations of the strong descending currents of air which affected the ascensional power of the balloon and necessitated a sacrifice of ballast has interest for aëronauts. "Some time after the ascent was begun it was noted, without immediate explanation, that the balloon showed a strange reluctance to rise, and considerable expenditure of ballast was necessary to overcome its sluggishness. This gave rise to the speculation that there were strong descending currents of air completing a circulation, the explanation of which would, perhaps, be given on the formation of clouds later in the day. The registering aneroid frequently indicated a slow fall of the balloon when the vertical current anemometer showed very little motion to bear this out. In the light of the further observations made later in the morning, it appeared to be correct that a steady downward current in the anti-cyclonic area was being encountered, which carried the balloon with it, while showing but little lateral velocity. On reaching higher levels the observed change in direction of the wind, giving a travel away from the cyclonic area, was in accordance with the circulation above indicated as likely to be occurring on the periphery of the low-pressure zone.

"The strong bands of cumuli ranged in advance of the cloud bank were of considerable interest, as indicating the approach of bad weather in waves, the hindmost of which formed the outskirts of the advancing solid cloud-bank behind.

"It was noteworthy that the forerunner of all those cumuli wave-crests, some 80 km. (50 miles) in front of the bank, was considerably stronger than those succeeding it, forming indeed a continuous roller of cloud across the field of view; and that a more or less constant decrease in volume of the crests behind it occurred until, when nearly below the balloon, and 15 km. (9 miles) from the cloud bank, they died away in *quasi*-cirro-cumulus, forming regular wave-crests of much smaller pitch and great tenuity, whose wave motion could be seen most beautifully from above by reason of its projection on the clearly visible ground beneath. The solution of the crests into clear vapour as they sunk into the wave hollows, and their re-appearance on again rising was strikingly visible. It seems probable that the strong line of cumulus wave-crest forming the first advancing front occurred as the result of the first contract of the indrawn rising lower air with the outwardly advancing upper air, and that it marked the boundary beyond which the upper current slowly descended in the anti-cyclonic area, to become perhaps a part of the lower inflowing current which had

acquired its first appreciable velocity there. As might be expected in that case, the subsequent cumuli wave-crests became less pronounced in character with the settling down of the two current strata into their normal uninterrupted courses."

In this ascent a steel cylinder of 1,000 litres of oxygen was carried for the use of the two observers when above 16,400 feet. The value of oxygen-carrying in high ascents is obvious from the following experiences of this ascent.

"The physiological effects of the rarity of the air at 7,000 m. (23,000 feet) were interesting, one of the observers finding that a stoppage of oxygen breathing for a minute or two caused a general greyness to overspread the whole view gradually, but without giving any feeling of sickness, while resumption of oxygen inhalation caused an instantaneous renewal of the actual colours of the landscape, but with greatly enhanced vividness, which, however, very rapidly decreased to the normal hues. Difficulty also in reading the instruments, except after a few seconds' oxygen breathing, was found at levels higher than 5,000 m. (16,400 feet).

The First Observations with "Ballons-Sonde" In America.

The following communication has been received from Mr. A. Lawrence Rotch, Director of the Blue Hill Observatory in America, in relation to his recent experiments with Ballons-Sonde at St. Louis.

"The balloons used in the experiments are the closed rubber balloons devised by Dr. Assmann, Director of the Prussian Aëronautical Observatory. These balloons are inflated with about 100 cubic feet of hydrogen gas; they expand in rising until they burst, and then the attached parachute moderates the fall. In some cases two balloons, coupled tandem, were employed, and as only one balloon bursts, the other is borne slowly to the ground and serves to attract attention. The instruments, which were furnished by M. Teisserenc de Bort, of Paris, record the temperature and barometric pressure upon a smoked cylinder, turned by clockwork; and the lightest of them in its basket weighs about one and one-half pounds. A notice attached to each requests the finder to pack the instrument carefully in a box and return either to St. Louis or to Blue Hill, with promise of a reward for the service.

"Owing to delays in obtaining the gas and apparatus, the experiments were not begun until the middle of September, during which month four ascensions took place. All of the balloons fell within a radius of fifteen miles, about fifty miles east of St. Louis. Twice the height of nine or ten miles was attained where a temperature of 68° F. below zero was recorded. These experiments were conducted by Mr. S. P. Fergusson, of the Blue Hill Observatory staff. Another series of ten ascensions was executed by Mr. H. H. Clayton, meteorologist at the Blue Hill Observatory, during the last part of November and the first days of December, mostly after sunset, in order to avoid the possible effect of insolation. Fortunately, all these balloons were also recovered, though the stronger upper air currents carried them further from St. Louis, three of them travelling more than two hundred miles, and two, at least, with a speed exceeding one hundred miles an hour, the direction of every balloon being toward the easterly semi-circle. Ten of the fourteen ascensions furnished good records, and the reduction of the later ones reveals lower temperatures than in September, for example, 72° below zero at the height of seven and three-quarter miles on November 25, and 76° below at six and one-quarter miles on the following day.

"The fact that all the balloons were recovered indicates the excellent topographical situation of St. Louis for dispatching them."

Letters to the Editor.

THE RIGIDITY OF KITES.

To the Editor of the Aëronautical Journal.

SIR,—Will you oblige by inserting a correction in our widely circulated "Journal"? The error is a statement by Mr. W. H. Dines on page 6 of the issue for Januury, 1905, to the effect that I consider it a barbarous practice to make a kite rigid. The paragraphs to which Mr. Dines alludes will bear repetition; they are as true now as when made in May, 1899:—

"The continuous diagonal struts boom out the lower jack-yards, and the cut diagonals keep the upper corners out, and when the centre tackles are set up the kite is perfectly rigid."

. . . . .

"The American copies of my cellular kites have no diagonal struts, the corners being pushed out by horizontal and vertical pieces of wood. In addition, they require to be guyed in

every direction by steel wire stays. This style appears to me barbaric. Horizontal pieces of wood adjacent to the horizontal or lifting calico surfaces must impair their efficiency. However tightly the calico may be stretched, the cobweb of wire stays used to keep the affair cubical must tend to slacken it. Again, if all is perfectly square and rigid before the kite is flown, the moment the wind blows on the calico, half the wire stays must slack up and allow the instrument to assume a rhomboidal form."

Yours faithfully,

LAWR. HARGRAVE.

Woollahra Point,
Sydney, N.S. Wales.
February 25, 1905.

With reference to this subject the following has been received from Mr. W. H. Dines:—

"I much regret having misrepresented Mr. Hargrave's opinion as to the rigidity of a kite, through the carelessness of not having verified my reference. Recent experience has confirmed my opinion that there are great advantages in using a flexible kite, provided that deformation proceeds symmetrically under increasing wind pressure, and in such a way that the pull on the wire is lessened.

The introduction of a spiral spring into one of the cross bamboos of the kites I use has reduced the jerkiness of the pull, and greatly increased the reliability of the kite in bad weather.

W. H. DINES.

June 22, 1905.

Notes.

The New German Aëronautical Observatory.—In a published description of the proceedings of the St. Petersburg Conference on the exploration of the atmosphere, Mr. A. Lawrence Rotch mentions the description given by Dr. Assmann, of the new aëronautical observatory to be erected in large grounds thirty-five miles south-east of Berlin. The reason for planting the observatory at that distance from the capital is that at the existing observatory in the suburbs of the city the trailing kite wires constitute a danger to life and property. The new establishment is to be in every respect a model one, where balloon and kite ascents will be made several times a day. A boat will be provided on the lake, which will permit the kites being flown even in calm weather, and in this way it is expected that practically continuous meteorological records will be obtained in the free air. As an indication of what had already been done in this way, Dr. Assmann exhibited a chart, encircling the hall, on which were plotted the isotherms at different heights above Berlin, obtained from the ascents of kites and captive balloons made daily for more than a year. From this Dr. Berson showed that the wind direction shifted to the right hand with increasing altitude.

M. Jacques Faure's Recent Balloon Journey of Fifteen Hours in a Storm.—M. Jacques Faure has added yet another to his ballooning exploits. Accompanied by Le Comte de la Salle and M. Tollander Basch, he recently ascended from Havre in the Aëro Club No. 3 and went over the sea. It appears that he successfully applied the apparatus for steadying the balloon, which travelled in the direction of Cherbourg at an altitude of only 30 feet above the surface of the water. About nine o'clock a severe storm arose, and the balloon was driven towards Havre at a speed of 50 miles an hour. When the balloon arrived at the shore it was found necessary to rise to 4,500 feet in order to get beyond the reach of the storm currents. He was successful in finding a current by which he traversed the whole of France from west to east. At 10 o'clock he landed in Belgium, having been fifteen hours in the air. M. Jacques Faure may be congratulated on his skilful utilisation of the upper current, by means of which he escaped out of ill-threatening circumstances.

Recent Experiments with Aëroplanes.—The *Edinburgh Evening Dispatch* of June 5 gives a somewhat full account of an experiment with Professor Montgomery's aëroplanes in America. The Professor is stated to have been enthusiastically working at his idea for 20 years. Unlike most inventors of aërial apparatus, he appears to have preferred that the first experiment should be performed by a deputy, and an aëronaut was entrusted with the demonstration of the gliding powers of the machine. The aëroplane to which the aëronaut was attached was towed up into the air until a height of 4,000 ft. was reached, when the rope which held the aëroplane to the balloon was cut, and the aëroplane was left dependent on the sustaining powers of the air.

The aëroplane, which weighs 42 lb., consists of two wing surfaces, curved after the suggestions afforded by bird wings, a flat tail, and a vertical keel. There are relative adjustments, partly automatic, partly under the control of the operator, for maintaining equilibrium.

But this experiment resolved itself into being not much more than a descent with a parachute, and one infinitely more dangerous than one of the approved form. If the descriptions of the descent are correct, the aëroplane appears to have been in the air twenty minutes, to have described circles, gone backwards and forwards, and to some extent risen after descending on ascending currents; but, in the absence of motive power to overcome gravity, the experiment cannot be called an attempt at flight.

The *Car*, which makes a feature of aëronautical notes in its issue of June 21, describes some recent but abortive experiments with M. Earnest Archdeacon's aëroplane: "The huge machine was placed on the Seine, near the Pont de Sèvres. It is ten métres long, and covers sixty métres of superficial area. Its weight is over 650 lb., and it is actuated by a 15 h.-p. motor. The aëroplane was drawn by the auto-

mobile boat, *La Rapière*, along the water, and at a given signal, when a sufficient speed had been attained and a good direction for the wind secured, the aëroplane was loosened, and with M. Voisin on board rose to a height of about twelve yards. The cord, however, was not cut, and the machine was drawn back on to the water. A second experiment was about to be made—this time with the aëroplane at liberty—but before the cord was cut or the flying machine had risen in the air, one of the watertight compartments which enabled it to float got broken in, with the result that the unfortunate aëroplane went to the bottom of the river.

The Santos Dumont No. XIV.—No one can reproach M. Santos Dumont with being self-satisfied with his aërial undertakings. The fact that he has now reached No. XIV. airship is a proof that he has not been contented with each airship he has in turn developed, and is determined to try a variety of form and arrangement. The *New York Herald* recently pointed out that in the No. XIV. the Brazilian aëronaut has directed his efforts towards obtaining the greatest possible speed. The airship has a length of 41 mètres, and is inflated with 190 mètres of pure hydrogen. The motive force is furnished by a Pengot machine of 14 horse-power, with a weight of 27 kilogrammes.

The Heliocoptère.—Experiments have recently been made in the grounds of the Aëro Club at St. Cloud to test the ascensional powers of an apparatus devised by the brothers Dufaux, and called the Héliocoptere. This consists of a light tubular framework five metres from end to end. At each end is mounted a pair of propellers made of parchment stretched on wooden frames. The propellers revolve in opposite directions, being drawn by propeller shafts and bevel gearings from a petrol motor mounted vertically amidships, and developing a little over 3 h.-p. The weight of the motor is only 4½ kilogrammes, and the weight of the whole machine 17 kilogrammes. In the experiments the ascending powers of the Héliocoptere were tested by attaching it to an endless rope passing over two pulleys, one near the ground and the other near the roof of the Aëro Club shed. When the motor was set working the machine rose swiftly and easily to a height of 90 feet. In a second experiment a sandbag weighing 12 lbs. was attached to the model, and this additional weight did not interfere with the ascent.

Experiments with Man-Lifting Kites at Aldershot.—Army jottings in the *Naval and Military Record* lately drew attention to the fact that Sapper Moreton, of the Balloon Section of the Royal Engineers, has established a record by remaining for an hour at an altitude of 2,600 feet, suspended from one of Mr. Cody's man-lifting kites. This feat bears out the high opinion that experts have expressed as to the stability of Mr. Cody's kites, and the experiment should have placed the value of the kite in war beyond doubt.

New Aëronautical Biographical Series.—M. Wilfred De Fonvielle, late president of the French Aëronatical Society, and honorary member Aëronautical Society of Great Britain, who is so well-known to the members of the latter Society, from having on more than one occasion taken an active part in its proceedings, is writing a most valuable series of articles on famous aëronauts in *Les Contemporains*. Before us is a particularly interesting one on Henry Giffard, and treating in full of his various inventions, devoting considerable space to his two well-known attempts at aërial navigation in navigable balloons of his own construction—tales which none could tell more vividly than M. Wilfred De Fonvielle.

Obituary.

COLONEL CHARLES RENARD.

In the sudden death of Colonel Charles Renard, the Director of the French Department of Military Aëronautics, on April 13 last, the cause of aërial navigation has lost one of its most ardent adherents. Only a short time before his death the Aëronautical Society of Great Britain had cause to consider at its meeting the importance of Colonel Renard's researches in navigable balloon construction, and therefore it is unnecessary to dwell in the present notice on the construction of the balloon "La France." It will suffice now to remind our readers that he, with his partner, M. Krebs, was the first to make a return journey to the place whence the balloon started. This fact is of itself sufficient to give him a high place amongst the makers of aëronautical history. But his memory also deserves honour for many services rendered to his country in connection with the general development of military aëronautics in France and the perfecting of many details of balloon accessories.

Amongst the many eminent persons who were present at his funeral ceremony at the church of St. Sulpice, in Paris, on April 17, were M. Fallières, President of the Senate, M. Doumer, President of the Chamber of Deputies, Captain Riberpray, representing the Minister of War, M. Janssen, M. Becquerel, M. Berthelot, M. Earnest Archdeacon, M. Camile Flammarion, M. Santos Dumont, Le Comte de Castillon de Saint Victor, M. Jacques Faure, M. Paul Tissandier, M. Hervé, and M. P. Y. Alexander, member of the Aëronautical Society of Great Britain.

Besides the honour of his position as

head of military aëronautics in France, Colonel Renard had many other honours bestowed on him. He was Président de la Commission Permanente Internationale d'Aéronautiques, Membre d'Honneur de de l'Aéro Club de France, Membre d'Honneur de l'Aéronautique Club de France, Membre du Conseil de Perfectionnement du Conservatoire National des Arts et Métiers, Membre du Conseil de la Société Frangaise de Physique, Ancien Président de la Société Frangaise de Navigation Aérienne, Membre de l'Association Vosgiennes de Paris, Membre de la Société Astronomique de France, Lauréat de l'Institut, Commandeur de la Légion d'Honneur, Officier de l'Instruction Publique, Commandeur des Ordres de St. Benoit de Aviz de Portugal, de Wasa de Suède, et de St. Stanilas de Russie, Chevalier de St. Anne de Russie.

Foreign Aëronautical Publications.

(In this list a selection of some of the more notable articles is only given).

L'AÉRONAUTE (Paris).

April, 1905.—Nouvelles expériences d'aviation. M. F. Roux. (*Continued.*)

May.—Rapport de M. Leloup sur les concours de cerfs-volants.—Observations de l'éclipse du 30 Août en ballon.—Nouvelles expériences d'aviation. M. F. Roux.

L'AÉROPHILE (Paris).

April.—Portraits d'Aéronautes Contemporains: Victor Louet. A. de Masfrand.—Le Colonel Charles Renard. Edouard Surcouf.—L'Observatoire de Blue-Hill. Henry de la Vauix.—Un nouveau racer aérien. A. de M.—Essai de lancement d'un aéroplane par une automobile. G. Hermite.—Les grandes ascensions, de Folkestone à Calais, un raid de 830 kilométres. Georges Blanchet.—Dispositif d'hélices légères. Vicomte Decazes.

May.—L'Hélicoptère des Frères Dufaux.—Le Concours de Bordeaux. George Bans.

LA CONQUETE DE L'AIR (Brussels).

June 1.—La Fête Historique de l' Aérostation du 23 Juillet au Parc du Cinquantenaire à Bruxelles.

June 15.—Fête Internationale du Gaz et des Aéronautes.

ILLUSTRIRTE AËRONAUTISCHE MITTEILUNGEN (Strassburg).

April.—Nochmals die deutschen Frauen und die Luftschiffahrt. Mœdebeck.—Lustige und traurige Episoden aus den ersten Jahren de Ballon.—Aera (1783).—Montgolfièren.—Aufsliege in Columbien. — Premier Concours d'appareils d'aviation non montés à Paris. G. Espitelier.

May.—Zur Geschichte der Luftschiffahrt.—Lehrreiche Aëronautische Photographien.—Der "Maikarpfen" der Japaner, Hofmann.

June.—Charles Renard.—H. Mœdebeck. Uber das Lebenswerk von Oberst Renard by G. Espitelier.—Uber Finsternismeteorologie und die Künftige Sonnenfinsternis vom 30 August, 1905.—Zur Wrightschen Flugmaschine.

WIENER LUFTSCHIFFER-ZEITUNG.

May, 1905. Von Paris nach Österreich.—Brief aus Algier. Wilfred de Fonvielle. Aus dem Jahr, 1870.—Felix Hansen.

June. Eine Hochfahrt auf 6064 meter. Léon Gheude.

BOLLETTINO DELLA SOCIETA AERONAUTICA ITALIANA (Rome).

March-April, 1905. Sull 'angolo "optimum" e sulle eliche di massimo rendimento teorico. Arturo Crocco.—Il Congresso Internazionale di Aerostazione Scientifica a Pietroburgo. L Palazzo.—L'esplorazione dell' atmosfere Libera. B. Dessau.

Applications for Patents.

(*Made in April, May, and June, 1905.*)

The following list of Applications for Patents connected with Aëronautics has been specially compiled for the AËRONAUTICAL JOURNAL by Messrs. BROMHEAD & Co., Patent Agents, 33, Cannon Street, London, E.C.

APRIL.

6824. March 31st. WILLIAM MCKELLAR AND JAMES WILLOX. **Apparatus for Propelling and Steering Air-ships.**

8212. April 17th. ALFRED HARDIE. **Improvements in and relating to Flying Machines, partly applicable to high-speed boats.**

MAY.

9688. May 8th. LOUIS ERNST. **Improvements in and relating to machines for Aërial Navigation.**

9767. May 9th. LOUIS AUGUSTE BECHT. **Improvements in or relating to Air-ships.**

10106. May 13th. REGINALD MANSFIELD BALSTON. **Improvements in or relating to Kites and similar apparatus for Aërial Flight.**

10366. May 17th. FRANZ RICHARD EMIL KOEHLER. **Improvements in the Movements of Air-ships.**

10516. May 19th. FRANZ RICHARD EMIL KOEHLER. **Improvements in the Movements and Safety of Ships on Water or Air.**

JUNE.

11748. June 5th. ARTHUR HENRY PHILLIP BLUNT. **Improvements in Flying Machines.**